

### **ABSTRACT OF THE DISCLOSURE**

Technology is disclosed for characterizing both mass uneven distribution and high speed uniformity of a tire. Mass uneven distribution is identified from analysis of at least two radial run out (RRO) measurements, wherein a first RRO measurement is obtained for a relatively high speed of at least about 600  
5 rotations per minute. A second RRO measurement may be at a relatively low speed less of at most about 180 rotations per minute if the effects of radial stiffness variation on the RRO is mall. If the effects of radial stiffness variation on the RRO can not be neglected, a third RRO at another high speed of at least above 600 rotations per minute is needed. RRO measurements are then  
10 decomposed into a plurality of harmonics and mass uneven distribution coefficients are calculated for the respective harmonics. The mass uneven distribution coefficients are then used to determine size and location of any mass unbalance, including mass uneven distribution and/or point mass. Mass unbalance characterization can be further applied to tire sorting processes and  
15 improvements to tire manufacturing. Measurement and analysis of tire high speed radial run out can also be coupled with low speed force measurements to determine and characterize tire high speed uniformity. Tire high speed uniformity characterization can also be applied to tire sorting processes and corresponding tire manufacturing process improvement, for example, in control  
20 and optimization of tire layer overlap or variation parameters.